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PROTEIN FOOD PRODUCT AND PROCESS FOR THE PREPARATION OF THE SAME

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The present invention relates to an edible protein food product of smooth, soft texture and high nutritive value which is particularly useful in special types of diets in lieu of meat, and to a process for the preparation thereof.

A protein food product in order to be suitable for feeding in lieu of meat to babies, invalids and other persons requiring special diet must meet certain requirements. Specifically, it must have a smooth, soft texture; it must have a high protein nutritive value, preferably at least comparable to that of meat; and it must have little or no off-flavor so that it can be palatably flavored by the addition of minor amounts of flavoring additives. The product must also have these qualities after heat treatment. The obtention of all of these requirements in one product is a problem of unusual difficulty. For example, many proteins isolated from common sources are too highly flavored and, when a suspension of unmodified protein of the proper concentration and pH is autoclaved, the suspension becomes too firm for use as a soft food such as baby food. The undesirable flavor and texture can sometimes be compensated for by lowering the concentration of protein in the product but this results in a product of low nutritive value.

We have discovered that vegetable proteins, preferably those of oilseed origin, such as soy protein, can be made into a protein food product which meets all of the above requirements by a process which involves, in part, partial digestion by a proteolytic enzyme of a relatively highly concentrated aqueous suspension of protein. Enzyme digestion of proteins is known and, while it was to be expected that a heated protein suspension would be less firm if the protein were first partially digested by an enzyme, it was not predictable that it would be possible to achieve a texture simulating, e. g., strained meat or that such texture could be obtained in a controlled and reproducible way or that the extent of digestion required would not result in the development of off-flavor. However, by only partially digesting the protein within certain fairly critical limits, we are enabled to produce a product of the desired texture practically free from off-flavor.

In accordance with the process of the invention, an aqueous suspension of vegetable protein is subjected to hydrolysis by a proteolytic enzyme until about 10 to 40%, preferably 20 to 30%, of the protein is digested as measured by the percent of nitrogen that is converted to a form soluble in water at the isoelectric point of the protein. Flavoring, coloring and nutritive additives can then be added and the product canned.

The final product is a mushy, smooth paste of determinant protein content varying in texture from a flowable semisolid to a cheese consistency. Without any flavoring additives, it is substantially free from off-flavor. Its protein nutritive value approximates meat or is even higher and it is capable of withstanding relatively high temperatures without development of off-flavor and without objectionable change in texture.

Having outlined the process generally, the various steps of the process will now be described in greater detail.

It is first necessary to prepare or obtain on the market a suitably concentrated aqueous suspension of vegetable protein whose nutritive value has not been damaged during isolation. As previously stated, we prefer to employ an oilseed protein and have obtained particularly good products with soy protein. There are several known and conventional methods for the isolation of protein from vegetable sources and any of these methods that do not harm the nutritive value or flavor of the resultant coagulated protein can be employed. We have found suitable, for example, water extraction, extraction with dilute calcium chloride solution and extraction with aqueous sodium hydroxide.

In the case of soy protein, however, a preferred extraction procedure devised by us comprises suspending flakes of soy bean meal in an aqueous solution of calcium hydroxide of about 0.003 molarity. Steam is then sparged into the suspension of flakes, with agitation, until the temperature of the suspension is about 60° C. The suspension is then pumped through a centrifuge to obtain a clarified extract, which, in the usual instance, has a pH of about 6.8 to 6.9. The protein in the extract is then coagulated by the addition of an acid, such as hydrochloric acid, to bring the pH to about 5 and subsequent centrifugation then yields a solid aqueous suspension of coagulated protein. Preferably, the coagulated protein is then resuspended in water for purposes of washing, and centrifuged again. The washed, coagulated protein can then be dried preparatory to preparing the protein food product therefrom or it can be stored in the wet state. If the coagulated protein is to be kept for a long time, it is preferred to tray dry or spray dry the material for purposes of storage although the wet cake of coagulated protein can be stored at low temperatures for reasonable lengths of time.

For the purposes of the present invention, it has been found that protein coagulated at a relatively high temperature, for example, from about 80° C. up to about 100° C., has less off-flavor, and provides a product of better texture and lighter color, and the final texture of the product is less sensitive to variations in the conditions and time of enzyme digestion. Furthermore, heat coagulation is desirable from the bacteriological standpoint. However, protein coagulated at temperatures as low as room temperature can also be used.

For the purposes of the present invention, it is preferred that the final product contain at least about 15% protein, including digestion products, by weight up to about 25% by weight in order to have approximately the same protein nutritive value as meat, or better. In order to obtain a product of this protein content, the suspension of protein should have a slightly higher protein content since the subsequent addition of additives results in a lowering of the protein content, and, therefore, we prefer to subject to enzyme digestion a suspension of coagulated protein having a coagulated protein content somewhat higher than 15%. The suspension at the time of digestion may also contain any additives which are to be included in the product. The adjustment of protein content can be carried out by the addition of water to the suspension prior to enzyme digestion.

In the enzyme digestion of the suspension there can be used any of several known proteolytic enzymes, from animal, plant, fungal, or microbial sources, such as papain and trypsin. In carrying out the digestion the pH and temperature of the protein suspension are usually adjusted to those for maximum activity of the particular enzyme used. For example, with papain the protein suspension is adjusted to pH 7 and heated to about 60–70° C. Usually less than 1% of enzyme,